Causes and Costs of Injury in Trapped Dungeness Crabs

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Note

Although aggressive behavior in decapod crustaceans is well researched, little work has focused on factors influencing injury in trapped crabs and survival consequences for released individuals. Injuries have been documented on crabs left in traps for various soak times (Shirley and Shirley, 1988), although sources of these injuries were never determined. Despite the economic importance of the Dungeness crab fishery, very little research has attempted to identify the causal agents of injury to this species. Therefore, we conducted a field study in Glacier Bay National Park to investigate the effect of trap soak time on injury rates in male Dungeness crabs (*Cancer magister*). We addressed two primary questions during this study: (1) is there a relationship between soak time, injury rate, and crab density; and (2) is there a relationship between soak time, injury rate, and crab size ratios (the ratio of trapped sublegal to legal crabs)?

To investigate these questions, we designed two different field experiments: soak time and crab density trials, and soak time and size ratio trials. For all experiments we used male crabs within two size classes (sublegal and legal) and two different soak times. The density trials used only sublegal crabs while varying the crab density, and the size ratio trials varied the ratio of legal to sublegal crabs while maintaining a constant crab density. Within a trial, crab claws were either bound (to serve as controls) or unbound. Injuries were recorded at the start and end of experiments.

Results from both types of experiments demonstrate that as trap soak time increased, injuries also increased (tables 1 and 2). Additionally, the bound claw traps had significantly less injuries than unbound claw traps (tables 1 and 2), suggesting that claw use is a cause of injury in trapped conspecifics. We found no relationship between new injuries and crab density, implying that injuries to trapped crabs are density-independent (table 1). The ratio of sublegal to legal crabs also had a significant effect on the number of new injuries to crabs, where traps with mostly sublegal crabs had more injuries than traps with mostly legal crabs (table 2).

Table 1. Summary data on the mean number of new injuries per crab per trap from the soak time and crab density trials.

		Mean	SE	n
Unbound chelae		0.93	0.11	19
	*			
Bound chelae		0.15	0.03	13
5-day soak time		0.38	0.07	16
	*			
20-day soak time		0.85	0.15	16
5 crab density		0.56	0.13	17
20 crab density		0.67	0.14	15

* indicates a significant difference ($p<0.05$) between fixed factor treatments.

Table 2. Summary data on the mean number of new injuries per crab per trap from the soak time and size ratio trials. A follow-up Tukey test was used to determine that the eight sublegal: four legal traps were different from the four sublegal: eight legal traps ($p > 0.05$).

		Mean	SE	n
Unbound chelae		0.89	0.07	32
	*			
Bound chelae		0.23	0.04	21
5-day soak time		0.52	0.10	27
	*			
20-day soak time		0.74	0.09	26
8 sublegal : 4 legal		0.73	0.10	17
12 legal	*	0.51	0.10	19
4 sublegal : 8 legal		0.66	0.12	17

* indicates a significant difference ($p<0.05$) between fixed factor treatments.

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Observations from video footage of traps suggest that new injuries are caused by an increase in agonistic interactions with increasing soak time, and that these injuries are unlikely to have been caused by cannibalism or competition over space (Barber, 2004). Qualitative investigations revealed that sublegal crabs appeared to be more aggressive than legal crabs when trapped with many conspecifics of similar size, and legal crabs may be more tolerant when trapped with similarly-sized crabs. This observation could also explain the increased number of injuries in traps containing high numbers of sublegal crabs. Our results also established that injuries to trapped Dungeness crabs are density-independent. Perhaps when crab density is high, the rate of agonistic interactions is low, suggesting that the crabs could be altering their behavior in accordance to changes in soak time or crab density.

Sublegal crabs are of particular concern to managers of the Dungeness crab fishery because these crabs will be released upon retrieval of the trap. It is possible that released injured crabs will exhibit a lower success rate in finding and defending mates, decreased foraging ability, and a lower survival rate than intact crabs, although these suggestions are based upon known effects of injury on other decapod crustacean species (Juanes and Smith, 1995). The consequences of injuries on the fitness of Dungeness crabs remain largely unknown (Juanes and Smith, 1995; Barber, 2004).

Recreational crabbers in Glacier Bay National Park, and presumably recreational crabbers in other areas within the range of the Dungeness crab, are known to leave their traps fishing for extended periods of time (>10 days). Commercial crabbers, on the other hand, normally soak their traps for much shorter durations (2-5 days) (J. Barber, personal observation). This information suggests that the recreational fishery may have a disproportionate impact on the number of injuries sustained by trapped crabs. Indeed, crabs in recreationally-fished areas within Glacier Bay appear to have more injuries than areas that are closed to crabbing (J. Barber, personal observation).

The results from this study suggest a need to monitor and regulate trap soak time in an effort to decrease injury to crabs. Future research should investigate methods to minimize injuries to crabs in traps and consider ways to educate recreational crabbers about the potential consequences of their fishing practices.

Acknowledgments

Support for this project was provided by the National Park Service and the PADI Project AWARE Foundation. We would especially like to thank the Alaska Department of Fish and Game, the NOAA Auke Bay Laboratory, Dr. Stanley Cobb, Dr. Thomas Shirley, James Dimond, Chad Soiseth, and countless field volunteers.

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Suggested Citation

Barber, J., and Lotterhos, K.E., 2007, Causes and costs of injury in trapped Dungeness crabs, *in* Piatt, J.F., and Gende, S.M., eds., Proceedings of the Fourth Glacier Bay Science Symposium, October 26–28, 2004: U.S. Geological Survey Scientific Investigations Report 2007-5047, p. 181-182.